

Interview Summary

Application No.

10/634,631

Applicant(s)

CARLSON, RALPH L.

Examiner

Nathan Bloom

Art Unit

2624

All participants (applicant, applicant's representative, PTO personnel):

(1) Nathan Bloom.(3) Ralph Carlson.(2) Jingge Wu.(4) Atty. Jacobs.

Date of Interview: 01 May 2007.

Type: a) ☒ Telephonic b) ☐ Video Conference
c) ☐ Personal [copy given to: 1) ☐ applicant 2) ☐ applicant's representative]

Exhibit shown or demonstration conducted: d) ☐ Yes e) ☒ No.

If Yes, brief description: _____.

Claim(s) discussed: 1-33.

Identification of prior art discussed: Mitoma (US 5611723).

Agreement with respect to the claims f) ☐ was reached. g) ☒ was not reached. h) ☐ N/A.

Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: See Continuation Sheet.

(A fuller description, if necessary, and a copy of the amendments which the examiner agreed would render the claims allowable, if available, must be attached. Also, where no copy of the amendments that would render the claims allowable is available, a summary thereof must be attached.)

THE FORMAL WRITTEN REPLY TO THE LAST OFFICE ACTION MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a reply to the last Office action has already been filed, APPLICANT IS GIVEN A NON-EXTENDABLE PERIOD OF THE LONGER OF ONE MONTH OR THIRTY DAYS FROM THIS INTERVIEW DATE, OR THE MAILING DATE OF THIS INTERVIEW SUMMARY FORM, WHICHEVER IS LATER, TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW. See Summary of Record of Interview requirements on reverse side or on attached sheet.

Examiner Note: You must sign this form unless it is an Attachment to a signed Office action.


Examiner's signature, if required

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record

A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews

Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.

All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:

- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:

- 1) A brief description of the nature of any exhibit shown or any demonstration conducted,
- 2) an identification of the claims discussed,
- 3) an identification of the specific prior art discussed,
- 4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
- 5) a brief identification of the general thrust of the principal arguments presented to the examiner,
(The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
- 6) a general indication of any other pertinent matters discussed, and
- 7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

Continuation of Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: Inventor described operation of invention and that this was different that Mitoma in that Mitoma does not teach the alignment of the ball in the 3rd dimension. Furthermore, applicant stated that the arrangement of the conveyance system with the 90 degree rotations would not have been obvious in view of Mitoma and that it provided a rapid and consistent transport and rotation of the ball as compared to those taught by Mitoma and Gordon. Applicant stated Declaration of Success & Long Felt need and was instructed to send in the proper documentation regarding these. Discussed the previously faxed proposed amendments, and it was determined that amended claims should be filed for further review in light of applicants arguments.

FACSIMILE COVER SHEET

To: Examiner Nathan J. Bloom
Fax No. 571-273-9321

Re: Serial No. 10/634,631
(Attorney Docket RCARL-001-US)
First Named Inventor: Ralph L. Carlson

Date: April 13, 2007

Dear Examiner Bloom:

In accordance with MPEP 713.01, the Applicant respectfully submits the attached PROPOSED AMENDMENT and requests an indication of the possibility of a telephonic interview at a mutually convenient date and time within the next three weeks, with a view toward discussion of the proposed amended and new claims. It is believed that an interview may lead to agreement on the claims and thereby advance the prosecution of the application.

The proposed participants in such a telephonic interview would include the Examiner, the undersigned, and inventor Ralph L. Carlson, and the Applicant can provide in advance of the interview a video demonstration of the claimed invention in operation, which may be of utility in discussing the invention.

If the Examiner could please contact the undersigned at his earliest convenience with one or more possible dates and times for such an interview, that would be greatly appreciated, and the undersigned would follow up to arrange and confirm an agreed date and time.

Respectfully submitted,

/David Jacobs/

David Jacobs, Reg. No. 31,770
Jacobs & Kim LLP
Attorneys for Applicant
Tel.: 617-202-9272

PROPOSED AMENDMENT - NOT FOR OFFICIAL FILING

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Patent Application:

Serial No. 10/634,631

USPTO Confirmation No. 7208

Attorney Docket: RCARL-001-US

Filing Date: 8/5/2003

First Named Applicant: Ralph L. Carlson

To: Commissioner for Patents
P.O. Box 1450
Arlington, VA 22313-1450

AMENDMENT

In response to the USPTO Action mailed 12/14/2006, please amend the above-identified application as indicated on the following pages.

PROPOSED AMENDMENT - NOT FOR OFFICIAL FILING**Amendments to the Specification**

Please amend the specification, without prejudice, as follows:

At Page 3, line 14, replace the paragraph beginning with "There are two main objectives..." with the following replacement paragraph, in which underlining and strikeouts show changes over the replaced paragraph:

There are two main objectives of this invention. The first is to provide a system and method that can automatically determine the spatial orientation of a spherical object, such as a game ball, by locating and identifying the position and two-dimensional orientation of an existing reference indicium such as a trade name, e.g., ~~Top-Flite, Titleist,~~ TOP-FLITE or TITLEIST brands for golf balls, or a graphical image or a pattern, such as a dimple pattern on a golf ball, etc., on the spherical object. The second objective of the system and method of the present invention is to manipulate the spatial orientation of the spherical object in the context of the defined position and two-dimensional orientation of the reference indicium so that an additional processing operation, e.g., printing, inspecting, etc., can take place at a predetermined location, i.e., the "target point", on the spherical object, i.e., the target point has a predetermined positional relationship with respect to the predetermined final position and two-dimensional orientation of the reference indicium.

At Page 9, line 27, replace the paragraph beginning with "The Euler angles required ..." with the following replacement paragraph, in which underlining and strikeout show changes over the replaced paragraph:

The Euler angles required to orient the spherical object O, in the context of the predetermined final position and two-dimensional orientation of the existing reference indicium I, are calculated by accurately measuring the position and two-dimensional orientation of the existing reference indicium I on the spherical object O to define or determine the actual position and two-dimensional orientation of the spherical object O at the first orienting work station ST2 ~~TS2~~ prior to implementing any of the orienting steps described above. This is accomplished by taking images, e.g., two photographs, which together encompass the entire surface area of the spherical object O and using conventional image processing techniques to accurately determine or define the position and two-dimensional orientation of the existing reference indicium I on the spherical object O. The term "image" as used herein refers to using an imaging system such as a line sensor camera and image acquisition device to gather a plurality of line data from the line sensor camera while the spherical object O is rotated at least one revolution about an axis that passes through the center of the spherical object O and is perpendicular to the image axis of the line sensor camera (see, e.g., reference numeral 28 in FIG. 2 which identifies a line sensor camera and reference character 28_{IA} which identifies the image axis of the line sensor camera 28 in FIG. 2). It will be understood by those skilled in the art that other types of imaging systems can be used in the practice of the present invention such as area scan cameras, and other imaging systems of like capability.

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Amendments to the Abstract

A new Abstract is attached hereto on a separate page.

PROPOSED AMENDMENT - NOT FOR OFFICIAL FILING

Amendments to the Claims

Please amend the claims, without prejudice, as follows, wherein underlining identifies added material and strikethroughs identify deleted material:

Listing of Claims:

1. (Currently Amended) A system for automatically orienting a spherical object using a reference indicium on the spherical object, comprising:

(A) means for automatically locating and defining a position and two-dimensional orientation of the reference indicium; and

(B) means for automatically orienting the spherical object by sequentially rotating the spherical object from the defined position and two-dimensional orientation determined by the automatic locating means through determined ~~predetermined~~ angles so that the reference indicium of the spherical object has a predetermined final position and two-dimensional orientation wherein a target point on the spherical object, which has a predetermined spatial relationship to the reference indicium, is positioned ~~prepositioned~~ for further processing,

wherein the automatic locating and defining means comprises:

(1) first and second locating work stations, each of the first and second locating work stations having a axis of rotation and being operative to rotate the spherical object around the axis of rotation;

(2) transposing means for conveying the spherical object between the first and second locating work stations in such manner that the spherical object is rotated through a single-degree of freedom by 90 degrees between the first and second locating work stations and between the second locating work station and the orienting means, respectively;

(3) an imaging system operative to generate an image of the spherical object at each of the first and second locating work stations as the spherical object is rotated about the axis of rotation of the first and second locating work stations through at least one revolution, respectively; and

(4) calculating means for processing the image of the spherical object generated at the first and second locating work stations, respectively, to locate and identify the defined position and two-dimensional orientation of the reference indicium and to determine angles for rotation for the spherical object by the orienting means;

wherein the calculating means is operative to process the image of the spherical object generated at the first locating work station to identify a coarse position and two dimension orientation of the reference indicium at the first locating work station and to determine an angle of rotation for the spherical object at the first locating station;

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the first locating work station means is operative to rotate the spherical object about the determined angle to move the spherical object to a second position at the first locating work station; and

the transposing means is then operative to convey the spherical object to the second locating work station wherein the spherical object is rotated through the single-degree of freedom by 90 degrees such that the reference indicium is at the defined position and two dimensional orientation on the equator of the spherical object at the second locating work station;

wherein the automatic orienting means comprises:

(1) first, second, and third orienting work stations, each having an axis of rotation and being operative to sequentially rotate the spherical object through one of the determined angles so that the reference indicium is transposed from the defined position and two-dimensional orientation at the first orienting work station to the predetermined final position and two-dimensional orientation at the third orienting work station wherein the target point on the spherical object is positioned for further processing; and

(2) transposing means for conveying the spherical object between the first and second and second and third orienting work stations in such manner that the spherical object is rotated through the single-degree of freedom by 90 degrees between the first and second orienting work stations and between the second and third orienting work stations, respectively;

wherein the transposing means comprises:

(1) a first transposing mechanism pivotally mounted intermediate the first and second orienting work stations and operative to convey the spherical object from the first orienting work station to the second orienting work station in such manner that the spherical object is rotated through the single-degree of freedom by 90 degrees; and

(2) a second transposing mechanism pivotally mounted intermediate the second and third orienting work stations and operative to convey the spherical object from the second orienting work station to the third orienting work station in such manner that the spherical object is rotated through the single-degree of freedom by 90 degrees; and

wherein the 90 degrees single-degree of freedom rotation provided by the transposing means between the first and second and the second and third orienting work stations are coplanar with the axes of rotation of the first, second, and third orienting work stations;

the second locating work station is equal to and functions as the first orienting work station; and
the determined angles of rotation implemented by the first, second, and third orienting work stations, respectively, comprise Euler angles of rotation .phi, .theta plus an additional 90 degrees, and .psi, respectively.

2 - 3 (Canceled).

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4. (Currently Amended) The system of claim 2 1 wherein the 90 degrees single-degree of freedom rotation provided by the transposing means between the first and second locating work stations and the second locating work station and the orienting means is coplanar with the axes of rotation of the first and second locating work stations.

5. (Currently Amended) The system of claim 2 1 wherein the imaging system comprises:
a first imaging means having an image axis perpendicular to the spherical object at the first locating work station;
a second imaging means having an image axis perpendicular to the spherical object at the second locating work station; and
wherein the first and second imaging means are operative to generate the image of the spherical object at the first and second locating work stations, respectively.

6. (Currently Amended) The system of claim 1 wherein the imaging system comprises:
a single line sensor camera having an imaging axis ~~imaging means~~;
a first set of mirrors aligned to capture the image of the spherical object at the first locating work station for the single line sensor camera ~~imaging means~~; and
a second set of mirrors aligned to capture the image of the spherical object at the second locating work station for the single line sensor camera ~~imaging means~~;
where the single line sensor camera ~~imaging means~~ is operative, using the first and second set of aligned mirrors, to generate the image of the spherical object at the first and second locating work stations, respectively, and wherein the first and second set of aligned mirrors position the axis of rotation of the first spherical object and the axis of rotation of the second spherical object on the imaging axis of the line sensor camera.

7-9 (Canceled).

10. (Currently Amended) A system for automatically orienting a spherical object using a reference indicium on the spherical object, comprising:

first and second locating work stations each having an axis of rotation and operative to rotate the spherical object about the axis of rotation;

first, second, and third orienting work stations each having an axis of rotation and operative to rotate the spherical object about the axis of rotation through a determined ~~predetermined~~ angle of rotation so that the reference indicium at the third orienting work station has a predetermined final position and two-dimensional

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orientation wherein a target point on the spherical object, which has a predetermined spatial relationship to the reference indicium, is positioned ~~prepositioned~~ for further processing;

transposing means for conveying the spherical object between the locating work stations and between the orienting work stations in such manner that the spherical object is rotated through a single-degree of freedom by 90 degrees each time the spherical object is conveyed between adjacent work stations, respectively;

an imaging system operative to generate an image of the spherical object at each of the first and second locating work stations as the spherical object is rotated about the axis of rotation of the first and second locating work stations, respectively; and

calculating means for processing the images of the spherical object generated at the first and second locating work stations to locate and identify a defined position and two-dimensional orientation of the reference indicium at the second locating work station and to determine the ~~predetermined~~ angles of rotation for the spherical object at the first, second, and third orienting work stations wherein the reference indicium is rotated from the defined position and two-dimensional orientation at the first orienting work station to the predetermined final position and two-dimensional orientation at the third orienting work station so that the target point is positioned ~~prepositioned~~ for further processing; wherein:

the second locating work station is equal to and functions as the first orienting work station;

the first orienting work station is operative to rotate the spherical object through one of the determined angles of rotation such that the reference indicium of the spherical object is moved from the defined position and two-dimensional orientation at the first orienting work station to a first reference position and two-dimensional orientation at the first orienting work station; and wherein

the transposing means is then operative to convey the spherical object from the first orienting work station to the second orienting work station so that the reference indicium is moved to a second reference position at the second orienting work station; and wherein

the second orienting work station is operative to rotate the spherical object through another of the determined angles of rotation such that the reference indicium of the spherical object is moved from the second reference position and two-dimensional orientation at the second orienting work station to a third reference position and two-dimensional orientation at the second orienting work station; and wherein

the transposing means is then operative to convey the spherical object from the second orienting work station to the third orienting work station so that the reference indicium is moved to a fourth reference position at the third orienting work station; and wherein

the third orienting work station is operative to rotate the spherical object through yet another of the determined angles of rotation such that the reference indicium of the spherical object is moved from the fourth reference position and two-dimensional orientation at the third orienting work station to the predetermined

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final reference position and two-dimensional orientation at the third orienting work station such that the target point on the spherical object is positioned for further processing; and.

wherein the one, another, and yet another determined angle of rotation implemented by the first, second, and third orienting work stations, respectively, comprise Euler angles of rotation .phi, .theta plus an additional 90 degrees, and .psi, respectively.

11. (Canceled).

12. (Original) The system of claim 10 wherein the imaging system comprises:

a first imaging means having an image axis perpendicular to the spherical object at the first locating work station;

a second imaging means having an image axis perpendicular to the spherical object at the second locating work station; and

wherein the first and second imaging means are operative to generate the image of the spherical object at the first and second locating work stations, respectively.

13. (Currently Amended) The system of claim 10 wherein the imaging system comprises:

a single ~~imaging means~~ line sensor camera having an imaging axis;

a first set of mirrors aligned to capture the image of the spherical object at the first locating work station for the single line sensor camera ~~imaging means;~~

a second set of mirrors aligned to capture the image of the spherical object at the second locating work station for the single line sensor camera ~~imaging means;~~

wherein the single line sensor camera ~~imaging means~~ is operative, using the first and second set of aligned mirrors, to capture the image of the spherical object at the first and second locating work stations, respectively, and wherein the first and second set of aligned mirrors position the axis of rotation of the first spherical object and the axis of rotation of the second spherical object on the imaging axis of the line sensor camera.

14. (Original) The system of claim 10 wherein the 90 degrees single-degree of freedom rotation provided by the transposing means between the locating work stations and the first, second, and third orienting work stations is coplanar with the axes of rotation of the first and second locating work stations and the first, second, and third orienting work stations.

15. (Currently Amended) The system of claim 10 ~~11~~ wherein the transposing means comprises:

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a first transposing mechanism pivotally mounted intermediate the first and second locating work stations and operative to convey the spherical object from the first locating work station to the second locating work station in such manner that the spherical object is rotated through the single-degree of freedom by 90 degrees; and

a second transposing mechanism pivotally mounted intermediate the first and second orienting work stations and operative to convey the spherical object from the first orienting work station to the second orienting work station in such manner that the spherical object is rotated through the single-degree of freedom by 90 degrees; and

a third transposing mechanism pivotally mounted intermediate the second and third orienting work stations and operative to convey the spherical object from the second orienting work station to the third orienting work station in such manner that the spherical object is rotated through the single-degree of freedom by 90 degrees.

16. (Original) The system of claim 15 wherein the 90 degrees single-degree of freedom rotation provided by the transposing means between the first and second locating work stations, the first and second orienting work stations, and the second and third orienting work stations is coplanar with the axes of rotation of the locating work stations and the orienting work stations.

17 -21. (Canceled)

22. (Currently Amended) The system of claim 10 wherein

the calculating means is operative to process the image of the spherical object generated at the first locating work station to identify a coarse position and two-dimensional orientation of the reference indicium at the first locating work station and to determine an angle of rotation for the spherical object at the first locating work station; and wherein

the first locating work station is operative to rotate the spherical object through the determined ~~predetermined~~ angle wherein the reference indicium is moved from the defined coarse position and two-dimensional orientation to a second defined position and two-dimensional orientation at the first locating work station; and wherein

the transposing means is operative to convey the spherical object from the first locating work station to the second locating work station wherein the spherical object is rotated through a single-degree of freedom by 90 degrees such that the reference indicium of the spherical object is located at the defined position and two-dimensional orientation at the second locating work station.

23 - 24 (Canceled).

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25. (Currently Amended) A method of automatically orienting a spherical object using a reference indicium on the spherical object so that a target point, which has a predetermined spatial relationship with the reference indicium, is positioned ~~prepositioned~~ for further processing, comprising ~~the steps of~~:

locating and defining a position and two-dimensional orientation of the reference indicium on the spherical object;

calculating, based on the defined position and two-dimensional orientation of the reference indicium, ~~predetermined~~ angles of rotation for the spherical object to move the reference indicium from the defined position and two-dimensional orientation to the predetermined final position and two-dimensional orientation;

rotating the spherical object at a first orienting work station through one of the calculated ~~predetermined~~ angles of rotation to move the reference indicium from the predefined position and two-dimensional orientation to a first reference position and orientation at the first orienting work station;

conveying the spherical object from the first orienting work station to a second orienting work station in a manner such that the spherical object is rotated through a single-degree of freedom by 90 degrees wherein the reference indicium is at a second reference position and two-dimensional orientation at the second orienting work station;

rotating the spherical object at the second orienting work station through another of the calculated ~~predetermined~~ angles of rotation to move the reference indicium from the second reference position and two-dimensional orientation to a third reference position and two-dimensional orientation at the second orienting work station;

conveying the spherical object from the second orienting work station to a third orienting work station in a manner such that the spherical object is rotated through a single degree of freedom by 90 degrees wherein the reference indicium is at a fourth reference position and two-dimensional orientation at the third orienting work station; and

rotating the spherical object at the third orienting work station through yet another of the calculated ~~predetermined~~ angles of rotation to move the reference indicium from the fourth reference position and two-dimensional orientation to the predetermined final position and two-dimensional orientation at the third orienting work station wherein the target point is positioned ~~prepositioned~~ for further processing;

wherein the one, another, and yet another calculated angles of rotation, respectively, comprise Euler angles of rotation .phi, .theta plus an additional 90 degrees, and .psi, respectively

26. (Currently Amended) The method of claim 25 wherein the step of locating the defined position and two-dimensional orientation of the reference indicium on the spherical object comprises ~~the steps of~~:

providing the spherical object having a random position and two-dimensional orientation of the reference indicium at a first locating work station;

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imaging the spherical object at the first locating work station;

determining a coarse position and two-dimensional orientation of the reference indicium using the generated image;

calculating an angle of rotation for the spherical object at the first locating work station using the generated image;

rotating the spherical object through the calculated angle of rotation to move the reference indicium from the coarse position and two-dimensional orientation to a second position and two-dimensional orientation at the first locating work station;

conveying the spherical object from the first locating work station to a second locating work station in a manner such that the spherical object is rotated through a single-degree of freedom by 90 degrees wherein the reference indicium is at the defined position and orientation at the second locating work station;

imaging the spherical object at the second locating work station; and

locating and defining the defined position and two-dimensional orientation of the reference indicium of the spherical object at the second locating work station using the generated image.

27. (Currently Amended) A system for imaging the surface of a spherical object, comprising:

a first work station having an axis of rotation and operative to rotate the spherical object about the axis of rotation, and wherein a plane of the spherical object perpendicular to the axis of rotation is defined as the rotational plane of the spherical object at the first work station;

a second work station having an axis of rotation and operative to rotate the spherical object about the axis of rotation, and wherein a plane of the spherical object perpendicular to the axis of rotation is defined as the rotational plane of the spherical object at the second work station;

transposing means for conveying the spherical object from the first work station to the second work station in such manner that the spherical object is rotated through a single degree of freedom by 90 degrees wherein the rotational plane of the spherical object at the first ~~work~~ working station is rotated through an angle of 90 degrees such that the rotational plane defined by the spherical object at the first work station is perpendicular to the rotational plane of the spherical object at the second work station; and

an imaging system positioned and operative to generate an image of the surface of the spherical object at each of the first and second work stations; and wherein

the imaging system is operative to generate a first image of the surface of the spherical object as the spherical object is rotated through at least one complete revolution about the axis of rotation of the first work station; and wherein

the imaging system is operative to generate a second image of the surface of the spherical object as the spherical object is rotated through at least one complete revolution about the axis of rotation of the second work station; and

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the first and second work stations are substantially identical in structure.

28. (Original) The system of claim 27 wherein the imaging system comprises:

a first imaging means having an image axis perpendicular to the spherical object at the first work station and operative to generate the first image of the surface of the spherical object; and

a second imaging means having an image axis perpendicular to the spherical object at the second work station and operative to generate the second image of the surface of the spherical object.

29 - 33 (Canceled).

34. (New) A system for automatically orienting a spherical object in three dimensions using a reference indicium on the spherical object, the system comprising:

four substantially identical work stations, each with an axis of rotation, each operable to rotate the spherical object about the axis of rotation, the four axes of rotations being parallel and coplanar;

transposing means comprising at least one mechanical gripper operable to move the spherical object from one station to a next station by rotating it through an angle of 90 degrees whereby the spherical object is positioned on the next station such that the new axis of rotation is perpendicular to the previous axis of rotation; and

a single line sensor camera positioned and operable to generate a single image of two spherical objects located at the at least first and second stations.

PROPOSED AMENDMENT - NOT FOR OFFICIAL FILING**Remarks**

Prior to this Amendment, claims 1-33 were pending in the application.

The Action mailed 12/14/2006 stated, in pertinent part, the following:

- 1) The Abstract was objected to as exceeding 150 words. A new Abstract is attached hereto on a separate page below.
- 2) The Action requested that the terms TOP-FLITE and TITLEIST be capitalized. This has been implemented by the present Amendment.
- 3) The Action requested that at page 10, line 1, the term "TS2" be changed to "ST2". This has been implemented herein.
- 4) The Action noted that renumbering of the final few claims is required. This has been implemented herein.
- 5) The Action requested that in the claims, "prepositioned" be changed to "positioned". This has been implemented herein.
- 6) The Action requested that in claims 2, 10 and 25, the language "to determine predetermined angles" be changed to "to determine the angles for". This has been implemented herein.
- 7) The Action alleged that in claims 6 and 31, insufficient antecedent basis existed for "imaging system" and "single imaging means", respectively. The present Amendment attends to this point.
- 8) Claim 1 was rejected under 35 USC 102(b) as being allegedly anticipated by Mitoma (US 5611723, hereinafter simply "Mitoma"). The present Amendment and the following arguments address this point, as well as the other points of art-based rejections noted herein and in the Action.
- 9) Claims 1, 2, 4, 5-10, 12, 14, 19-21, 23, 25, 27-29 and 32 were rejected under 35 USC 103(a) as being allegedly unpatentable as obvious in view of Mitoma.
- 10) Claims 27 and 33 were rejected under 35 USC 103(a) as being allegedly unpatentable as obvious in view of a combination of Mitoma plus Welchman (US 6630998, hereinafter "Welchman") and Petry (US 5859923, hereinafter "Petry").
- 11) Claims 1, 6, 10, 13, 27, 30 and 31 were rejected under 35 USC 103(a) as being allegedly unpatentable as obvious in view of a combination of Mitoma and White (US 4972494, hereinafter "White").
- 12) Claims 1-3, 10, 11, 15-18, 22, 25 and 26 were rejected under 35 USC 103(a) as being allegedly unpatentable as obvious in view of a combination of Mitoma and Gordon (US 5632205, hereinafter "Gordon").

The Claims

Independent Claim 1 has been amended, without prejudice, to add recitations of claims 2, 3, 7-9, 11 and 23-24. Independent Claim 10 has been amended, without prejudice, to add recitations of claims 11 and 23-24. Independent claim 25 has been amended, without prejudice, to add recitations relating to Euler angles. Independent claim 27 has been amended, without prejudice, to add a recitation that the first and second

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workstations are substantially identical in structure. Claim 34 is new, reciting, among other aspects, four substantially identical workstations. This Amendment also cancels claims 2-3, 7-9, 11, 17-21, 23-34 and 29-33 without prejudice, including without prejudice to re-filing such claims in a continuation case or otherwise. No new matter has been added, and support for the amended claims and the new claims is found in the application, including collectively the specification, drawings and claims, as originally filed.

Among other aspects, the amended independent claims and the new claims recite that multiple workstations are identical in structure, and that angles of rotation comprise Euler angles of rotation ϕ , θ plus an additional 90 degrees, and ψ , respectively.

The Cited References

Mitoma is directed to a burr-removing apparatus for golf balls. In particular, it discloses an apparatus for modifying the attitude of a golf ball having burrs formed thereon, the apparatus having a second station in which a CCD camera takes image data of the golf ball while rotating, one time, the golf ball around the X-axis by a step motor, and the rotational angle around the X-axis and that around the Z-axis, with which the equator having burrs formed thereon are required to be horizontal, are calculated in accordance with the image data; fourth and fifth stations in which step motors rotate the golf ball around the X-axis and Z-axis by the foregoing angles to modify the attitude of the golf ball; and a sixth station in which a CCD camera takes image data of the golf ball to finely modify the attitude of the golf ball by step motors.

Welchman is directed to a system that purports to inspect game balls to check the quality of surface treatments applied thereto. The inspection system includes an imaging system including a detector for creating and providing an image signal of the ball being inspected to an analyzer. The inspection system also includes an environmental modification device to account for contours on the spherical surface of the ball such that the imaging system can create and analyze still images of the ball. A sorter or reject device, may be provided to act upon the ball based on an output signal from the analyzer.

Petry is directed to a machine vision system that purports to inspect a mark (such as a multi-character mark) on an integrated circuit device. The system provides search and defect analysis for the mark, individual characters of the mark, and the foreground and the background of the mark. The system provides for search and defect analysis reports thereof. It includes components for operator training search and defect analysis models for the whole mark, and for automatic training of such models for individual characters of the mark.

White is directed to a package inspection system that purports to measure predetermined parameters of cigarette packages, compares the measured parameters with predetermined values, evaluates from the measured parameters the integrity of the package and determines whether the packages is acceptable. The system views one or more package sides, using one or more line scan or area array cameras and/or optics to enable multiple package side images to be obtained using a single camera

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Gordon is directed to apparatus purporting to achieve the spatial orientation of a game ball, using a camera for imaging the ball and its spatial orientation, a computer communicating with the camera for processing the image and for computing a required spatial rotation to bring the ball into a desired spatial orientation, and motors communicating with the computer for rotating the ball to a desired orientation without substantially moving the center of the spherical object.

The Combinations of Features Required by the Amended Claims are Neither Taught Nor Suggested by the Cited References

Based on the amended and new claims on the one hand, and the disclosures of Mitoma, Welchman, Petry, White and Gordon on the other, it will be seen that the combinations of features required by the amended claims and the new claims added herein are neither taught nor suggested by the cited references. The subject matter of the amended and new claims therefore is neither anticipated nor rendered obvious by the references, taken separately or in combination, and thus distinguish patentably over the art of record. It is therefore respectfully requested that the above-noted rejections be withdrawn and the amended and new claims be indicated to be allowable.

Mitoma, for example, fails to teach how to orient a ball in all three dimensions; it does not use identical multiple workstations, parallel axes, and an indexing means that is coplanar with the axes of rotation at each station (thus allowing much faster indexing, as well as economies of scale and lower cost, while the parallel axes allow the stations to be located closer together, thus reducing the time required to transport and index the ball from one station to the next.) Using four parallel axes of rotation the stations can be positioned closer together than in the Mitoma machine, and this allows for the simplified indexing method, as claimed, of rotating the ball from one station to the next. This is significantly more efficient because it requires just one move (rotate) instead of three as in Mitoma (lift, transfer, and place). The closer positioning of the axes, combined with the single move, results in approximately doubling the operating rate.

Also unlike Mitoma, the claims call for using the first station as both an imaging station and a coarse orienting station. The second station is used as an imaging station and the first of multiple fine orienting stations. The indexing of the ball by rotating it from one station to the next is not described in or suggested by Mitoma.

The claims also call for coplanar axes, which is not taught in Mitoma, in that Mitoma's axes are not coplanar. Moreover, Mitoma does not teach a system where the axes are parallel or where the ball can be indexed by a single, 90 degree rotation of an indexing means. Having the axes be parallel has the added advantage that the camera(s) can be isolated behind a pane of glass that is positioned between camera(s) and the balls, thus protecting the cameras and reducing maintenance requirements.

The Action notes that Mitoma in column 7, line 13 describes a conveyance arm that moves vertically as well as in a lengthwise direction (i.e., with two degrees of freedom), and alleges that this somehow teaches

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or renders obvious the Applicant's claimed indexing system. That is not correct, however. The claimed indexing mechanism rotates through one degree of freedom to index the balls from one station to the next. This is significantly more efficient and mechanically trouble-free than the pick-transfer-place method taught by Mitoma. The claimed single degree of freedom indexing mechanism also requires the stations to have parallel axes, which again, is a feature not taught or suggested by Mitoma.

White teaches an inspection system that uses mirrors to allow one camera to image more than one surface of a part, and the camera described is an area scan "video" camera. White does not teach or suggest how to apply the line scan camera so that it can simultaneously image two spherical objects that are spinning on separate, parallel axes; nor does he address the issue of depth-of-field that is created by his mirror system. In contrast, the claimed mirror arranged maintains the same focal distance to each ball so that depth of field is not an issue. In order to properly image a spherical object with a line scan camera the line sensor must be in line with the spin axis. For this application, the two spin axes must be positioned by the mirrors so that they both line up with the axis of the line sensor element in the camera. The balls must be positioned to also maintain the maximum use of the line sensor so that adequate resolution is maintained. The claimed invention enables this, while White and the other references neither teach nor suggest this.

In addition to the foregoing, it is noted that while Mitoma teaches a system that uses two rotation stations for imaging the ball, followed by two positioning stations, the method of orienting a ball in three dimensions, using the three Euler angles, is neither taught nor suggested by Mitoma. Mitoma's two positioning stations can only position the ball in two dimensions, i.e., the equator can be positioned horizontally but the ball will not be oriented around the axis that is perpendicular to the equatorial plane. Therefore a target "point" on the ball cannot be positioned (as it can be in the claimed invention); only a target "great circle" can be positioned by Mitoma's structure. And again, Mitoma does not teach or suggest rotating the ball through a 90 degree angle.

More particularly, Mitoma teaches a system in which a ball is rotated about two perpendicular axes ST3 and ST4, and then fine-adjusted about two more perpendicular axes at station ST5. Mitoma's first two stations ST1 and ST2 are used only for rotating the ball to acquire the image, and no positioning is done at those stations. Thus, Mitoma does not teach or suggest either orienting the ball in three dimensions or using a set of three Euler angles required to orient the ball in three dimensions. Mitoma teaches orienting the ball in two dimensions over two positioning stations ST3 and ST4, while the claimed subject matter uses three Euler angles to orient the ball in exactly three stations. The second Euler angle has 90 degrees added to it to allow it to work with stations that have parallel axes of rotation -- again, a feature not present, taught or suggested by Mitoma.

With regard to claims 26, 27 et seq., it is noted that the claimed system utilizes what information is available from the first imaging station to position the ball so that all the necessary information will be attained at the second imaging station to successfully orient the ball in exactly three moves. The first imaging station

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ensures that the desired indicia will be found at the second station. In Mitoma, in contrast, there is no locating done at the imaging stations. If the ball's equator is not found at the first imaging station it is assumed that it will be found at the second imaging station. There is no teaching or suggestion in Mitoma of using information from a first imaging station to position the ball so that all the necessary information will be attained at the second imaging station to enable successful orientation of the ball, in three dimensions, in exactly three moves, as required by the claims.

Similarly, Mitoma teaches a system where the two imaging axes are perpendicular and (their stations) are mechanically quite different from one another. As a result, Mitoma's means to index the ball from one station to the next requires three moves per transport over two degrees of freedom: i.e., lift, transfer, and place. This is far more complex and potentially slower and more trouble-prone (borne out in real-world observation of the actual machines as noted below upon Applicant's direct observation and knowledge), than the claimed invention. As required by the claims, the Applicant's invention uses the more efficient method of indexing the ball by rotating it through one degree of freedom to simultaneously transfer the ball and present it to a second, mechanically identical station, so that the axis of rotation of the ball at the second station is perpendicular to the previous axis of rotation, while the two stations rotate on parallel axes. The teachings of Mitoma are thus fundamentally different and in fact, diametrically opposed to the mechanisms and methods required by the claims.

With regard to recitations in new claim 34, it is noted that Mitoma teaches a system that uses vacuum to hold the ball while it is transported from one station to the next. Mitoma does not teach or suggest the claimed use of a mechanical gripper, which is superior because the grippers maintain the center of the ball on the plane defined by the spin axes of the two adjacent workstations. Therefore, the vertical moving cup 14 of Mitoma that serves the purpose of controlling the center of the ball, and adds significantly complexity to stations ST2 and ST4 is not required. Moreover, claim 34 requires substantially identical workstations in a combination of structures and features that is not taught or suggested by any of the cited art, taken separately or in combination.

With regard to Gordon, the system described therein is based on using an iterative process to orient the ball. The Gordon machine repeatedly images the ball and moves it based on what it "sees" until the ball is in the correct or nearly correct orientation. As noted below based on the Applicant's real-world knowledge and observation of the various actual machines built in accordance with the Gordon design, the Mitoma design, and the Applicant's claimed invention, the Gordon system results in variable times to orient the ball, instead of a uniform and predictable orientation time, resulting in downstream challenges for the machine. The Applicant's claimed invention, in contrast, uses exactly three moves, with a predictable time interval, to orient the ball.

In view of the foregoing, the Applicant respectfully asserts that the subject matter of the amended and new claims is neither taught nor suggested by the cited references, taken separately or in combination.

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Video Demonstration: The Applicant can also provide a video of the claimed invention in operation, if the Examiner is amenable to considering it. Given the dynamic and high-speed nature of the machine constructed in accord with the claimed invention, a video can be useful to clearly see the multiple differences between the claimed invention and the cited references.

The Present Invention Has Enjoyed Considerable Commercial Success Owing to the Subject Matter of the Claims

As additional evidence of the non-obviousness of the subject matter of the claims, it is noted that the present invention has enjoyed considerable commercial success, and that such success is directly attributable to the subject matter of the claims, and that this success has been due to industry-acknowledged advantages of the present invention over the structures taught and disclosed in the Mitoma and Gordon references discussed above.

Declaration: The Applicant can provide a Declaration in this regard, if the Examiner is amenable to considering it.

In particular, inventor Ralph L. Carlson has worked in this area of technology for many years, including for the Titleist company (hereinafter "Titleist", which is now the Acushnet Company, an operating company of Fortune Brands, Inc.). Mr. Carlson is unquestionably an expert in this area of technology and has personal knowledge and observations relating to machines constructed in accordance with the Mitoma and Gordon disclosures. On information and belief, Titleist purchased a burr-removing machine described in the Mitoma reference, in or about 1995, but later substantially ceased to use the Mitoma device. On information and belief, Titleist continued to have a need for a machine to orient finished golf balls so that a custom logo could be printed on them in the correct location relative to the previously-placed manufacturer's printing. On information and belief, Titleist hired Gordon (i.e., an inventor named in the Gordon reference noted above) to design the machine later described in the Gordon patent. The Gordon machine orients the ball at one station so that the machine can keep trying until the ball is successfully oriented. This allowed a higher orientation success rate, but caused the time required to orient the ball to vary significantly from one ball to the next, a significant problem for downstream processing.

Moreover, the average cycle rate with the Gordon machine was still less than half of what is achieved by machines constructed in accordance with the Applicant's invention. Thus, until the advent of Applicant's invention, the industry still had a long-felt need to orient golf balls in all three dimensions at a high operating rate and over a highly repeatable time interval, which was not achieved by machines constructed in accordance with the Mitoma or Gordon references.

The Applicant recognized that the sequential approach, described and claimed in the Applicant's present patent application and not present in the prior art, was the best way to achieve higher operating rates, and devised the claimed method of using four identical, rotating stations and the rotating grippers that index

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the balls through the machine while simultaneously rotating them 90 degrees. This set of features, as recited in and required by the amended and new claims, is a key advantage of the claimed structures and methods. The Applicant also incorporated a mirror design as a means to reduce the cost of building the machines.

As a result of these differences and substantial improvements and technical advantages over the prior art, the Applicant has to date sold at least thirteen (13) machines constructed in accordance with the claimed subject matter to customers including Titleist and most of the other major golf ball manufacturers, with total sales thereof in excess of one million dollars (\$1,000,000.00), and expects such sales to continue into the future. There exist numerous applications for this technology in golf ball manufacturing. It is the Applicant's observation that there appear to be no other machines currently on the market that use machine vision to orient the ball.

Conclusion

The amended and new claims differ substantively and patentably over the cited Mitoma, Gordon, White, Petry, Welchman, and other art of record.

With respect to Mitoma, for example, that reference clearly teaches a system where the two imaging axes are perpendicular and their stations are mechanically quite different from one another. As a result, Mitoma's means to index the ball from one station to the next requires three moves per transport over two degrees of freedom: i.e., lift, transfer, and place. This is far more complex and potentially slower and more trouble-prone (borne out in real-world observation of the actual machines as noted herein upon Applicant's direct observation and knowledge), than the claimed invention. As required by the claims, the Applicant's invention uses the more efficient method of indexing the ball by rotating it through one degree of freedom to simultaneously transfer the ball and present it to a second, mechanically identical station, so that the axis of rotation of the ball at the second station is perpendicular to the previous axis of rotation, while the two stations rotate on parallel axes. The teachings of Mitoma are thus fundamentally different and in fact, diametrically opposed to the mechanisms and methods required by the claims. Mitoma teaches away from, and does not anticipate or render obvious, the subject matter of the claims presented and discussed herein.

This Amendment attends to each point raised in the pending USPTO Action; and the Examiner is respectfully requested to allow the claims.

Please charge any claims fees or other amendment fees required hereby to the above-noted Deposit Account used in connection with filing this Amendment. If there are any questions, the Examiner is cordially invited to contact the undersigned by telephone as noted below.

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Respectfully submitted,

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PROPOSED AMENDMENT - NOT FOR OFFICIAL FILING**Abstract**

A system, methods and apparatus for rapidly and automatically orienting spherical objects, such as game balls, for subsequent downstream processing comprises a series of processing steps that can be performed at four separate, mechanically similar (or even identical) workstations. An imaging sub-system needs only one camera to image the spherical object and manage the work process. The method of transposing the spherical object between work stations is simple, requiring an apparatus having only one degree of freedom to simultaneously convey and rotate spherical objects, and the system and method can automatically and rapidly determine the object's spatial orientation and change the orientation as required for downstream processing.